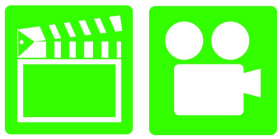
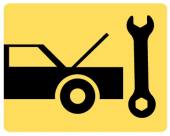
Manual Drive Train and Axles 1st Edition

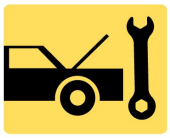
Chapter 14 Drivetrain Electricity and Electronics

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This course or class covers operation and service of **Manual Drive Trains and Axles.** It correlates material to task lists specified by ASE and NATEF.
Motivate Learners	Explain how the knowledge of how something works translates into the ability to use that knowledge to figure why the engine does not work correctly and how this saves diagnosis time, which translates into more money.
State the learning objectives for the chapter or course you are about to cover and explain this is what they should be able to do as a result of attending this session or class.	Explain the chapter learning objectives to the students. 1. Prepare for the Manual Drivelines and Axles (A2) ASE certification test content area "C" (Transmission/Transaxle Diagnosis and Repair). 2. Explain the characteristics of electricity. 3. Differentiate between conductors, insulators, and semiconductors. 4. Explain the units of electrical measurement. 5. List the parts of a complete circuit. 6. Discuss the types of electrical circuit faults. 7. Explain how to detect and measure electrical voltage, current, and resistance. 8. Discuss the purpose of terminals, connectors, relays, and switches. 9. Explain the operation of speed sensors and throttle position (TP) sensors. 10. State the need for networks and discuss network classifications.
Establish the Mood or Climate	Provide a *WELCOME,* Avoid put downs and bad jokes.
Complete Essentials	Restrooms, breaks, registration, tests, etc.
Clarify and Establish Knowledge Base	Do a round robin of the class by going around the room and having each student give their backgrounds, years of experience, family, hobbies, career goals, or anything they want to share.

ICONS	Ch14 Drivetrain Electricity and Electronics
	**1. SLIDE 1 DRIVETRAIN ELECTRICITY AND ELECTRONICS**
	2. SLIDES 2-4 EXPLAIN OBJECTIVES
	**Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/**
	WEB SITE IS CONSTANTLY UPDATED
	**5. SLIDE 5 EXPLAIN** Characteristics of Electricity
	6. SLIDE 6 EXPLAIN Figure 14–2 The nucleus of an atom has a positive (+) charge and the surrounding electrons have a negative (–) charge.
	**ANIMATION ON AN ATOM WWW.MYAUTOMOTIVELAB.COM** HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYAUTOMOTIVELAB_2/ANIMATIONS/A7_ANIMATION/CHAPTER31_FIG_31_2/INDEX.HTM
	**ANIMATION ON AN LIKE & UNLIKE ATTRACTION WWW.MYAUTOMOTIVELAB.COM** HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYAUTOMOTIVELAB_2/ANIMATIONS/A7_ANIMATION/CHAPTER31_FIG_31_4/INDEX.HTM
	**DISCUSSION: DISCUSS FLOW OF ELECTRICAL CURRENT AND HOW THE CONSTANT FLOW, OR JUMPING OF ELECTRONS, CREATES CURRENT**
	**ELECTRON FLOW**
	**DEMONSTRATION: USE MAGNETS TO DEMONSTRATE HOW OPPOSITES FORCES ATTRACT & LIKE FORCES REPEL. SHOW HOW MAGNETS ATTRACT & REPEL EACH OTHER DEPENDING ON ORIENTATION OF THEIR POLES.**
	**7. SLIDE 7 EXPLAIN** Conductors, Insulators, Semiconductors
	8. SLIDE 8 EXPLAIN Figure 14–7 Insulators are elements with five to eight electrons in the outer orbit.
	**DISCUSSION: HAVE STUDENTS DISCUSS DIFFERENT CONDUCTORS. WHY IS COPPER MOST COMMONLY USED CONDUCTOR IN ELECTRICAL SYSTEMS.**

ICONS	Ch14 Drivetrain Electricity and Electronics
	**DISCUSSION: DISCUSS INSULATORS & REASON THEY MAKE POOR CONDUCTORS. WHAT IS RELATIONSHIP BETWEEN NUMBER OF ELECTRONS AN INSULATOR MATERIAL HAS & ITS ABILITY TO ACQUIRE & RELEASE ELECTRONS?**
	**COMPLETE TASK SHEET ON ELECTRICAL FUNDAMENTALS**
	**9. SLIDE 9 EXPLAIN** Electrical Measurement
	**DEMONSTRATION: SHOW HOW DMM MEASURES VOLTAGE. USE TRAINER TO SHOW STUDENTS MEASURING VOLTAGE**
	**ANIMATION: RESISTANCE (FIGURE 3-19)** **WWW.MYAUTOMOTIVELAB.COM** **HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYAUTOMOTIVELAB_2/ANIMATIONS/A7_ANIMATION/CHAPTER31_FIG_31_19/INDEX.HTM**
	**DISCUSSION: HAVE STUDENTS TALK ABOUT RESISTANCE TO ELECTRON FLOW, OR OHMS. HOW DOES MATERIAL USED AS A CONDUCTOR AFFECT RESISTANCE?**
	**ELECTRON TRAVEL, HEAT**
	**DISCUSSION: ASK STUDENTS TO DISCUSS HEAT, LIGHT, PRESSURE, CHEMICAL, & MAGNETIC MEANS OF PRODUCING ELECTRICAL CURRENT. WHICH PRINCIPLE IS BASIS OF AUTOMOTIVE BATTERY? WHICH PRINCIPLE IS BASIS FOR HOW AN ALTERNATOR WORKS?**
	**Electron Travel, Light**
	Electron Travel, Magnet
	Electron Travel, Pressur
	**10. SLIDE 10 EXPLAIN** Parts of a Complete Circuit
	11. SLIDE 11 EXPLAIN Figure 14–16 The return path back to the battery can be any electrical conductor, such as a copper wire or the metal frame or body of vehicle

ICONS	Ch14 Drivetrain Electricity and Electronics
	**DEMONSTRATION: DEMONSTRATE BASIC ELECTRICAL CIRCUIT ON TRAINER. SHOW (FIGURE 4-1)WHAT HAPPENS WHEN CIRCUIT IS SHORTED TO GROUND**
	**TRAINER TASK: ALLOW STUDENTS TO BLOW FUSE BY CREATING A SHORT CIRCUIT, OBSERVING WHAT IT TAKES TO CREATE SHORT CIRCUIT AND WHAT RESULTS ARE FOUND**
	**DISCUSSION: DISCUSS GROUND PATH. WHY DOESN'T A SEPARATE GROUND WIRE HAVE TO BE RUN FROM THE BATTERY TO EACH ELECTRICAL LOAD? DISCUSS HOW AND WHY A SHORT-TO-VOLTAGE OCCURS. WHAT IS THE REASON THAT A SHORT-TO-VOLTAGE MAY/MAY NOT BLOW FUSE?**
	12. **SLIDES 12-13 EXPLAIN** Types of Electrical Circuit Faults
	**DISCUSSION: ASK STUDENTS TO DISCUSS EFFECTS OF HIGHER THAN-NORMAL RESISTANCE ON VARIOUS COMPONENTS IN AN AUTOMOTIVE ELECTRICAL SYSTEM. WHAT CAN CAUSE HIGH RESISTANCE?**
	**DEMONSTRATION: USE AN INDUCTIVE AMMETER OR CHARGING SYSTEM TESTER TO SHOW THAT *AMOUNT OF CURRENT LEAVING BATTERY ON POSITIVE IS RETURNED ON NEGATIVE SIDE.***
	**Ohm's Law, Current** **Ohm's Law, Resistance** **Ohm's Law, Volt**
 	**DISCUSSION: ASK STUDENTS TO TALK ABOUT OHM'S LAW. WHAT IS APPLICATION OF OHM'S LAW IN AUTOMOTIVE WIRING CIRCUITS?**
	14. **SLIDE 14 EXPLAIN** Detecting and Measuring Electrical Voltage, Current, and Resistance 15. **SLIDE 15 EXPLAIN Figure 14–31** Using a digital multimeter set to read ohms (Ω) to test this light bulb. The meter reads the resistance of the filament

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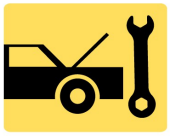
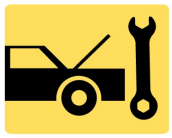
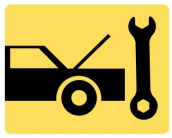
	**Measure AC Ripple** **Measure Battery Voltage Drop** **Meter Usage Battery Volt Check** **Meter Usage Check CAN Circuit** **Meter Usage Measure Amps** **Meter Usage Measure Frequency** **Meter Usage Measure Ohms** **Meter Usage Measure Volts** **Meter Usage Testing Diode**
	**COMPLETE TASK SHEET ON ELECTRICAL CIRCUITS**
	**DISCUSSION: DISCUSS VARIOUS SCALES AND SETTINGS ON A DMM. WHAT IS REASON THAT TEST RESULTS USING A DMM ARE MORE ACCURATE? DISCUSS THE AUTORANGE FEATURES**
 	**NATEF TASK SHEET: OHM'S LAW: DIAGNOSE ELECTRICAL/ELECTRONIC INTEGRITY OF SERIES, PARALLEL & SERIES-PARALLEL CIRCUITS USING PRINCIPLES OF ELECTRICITY (OHM'S LAW)**
 	**NATEF TASK SHEET DEMONSTRATE PROPER USE OF DIGITAL MULTIMETER (DMM) DURING DIAGNOSIS OF ELECTRICAL CIRCUIT PROBLEMS, INCLUDING: SOURCE VOLTAGE, VOLTAGE DROP, CURRENT FLOW, & RESISTANCE**
	16. **SLIDES 16-17 EXPLAIN** Terminals, Connectors, Relays, and Switches 18. **SLIDE 18 EXPLAIN Figure 14–37** Some terminals have seals attached to help seal the electrical connections.
	**VIDEO: WIRING HARNESS INSTALLATION** http://media.pearsoncmg.com/ph/chet/chet_mylabs/akamai/template/video640x480.php?title=Wiring%20Harness%20Installation&clip=pandc/chet/2012/automotive/Installing_EFI_System/T12CD9.mov&caption=chet/chet_mylabs/akamai/2012/automotive/Installing_EFI_System/xml/T12CD9.xml
	**VIDEO: FUSES & CIRCUIT BREAKERS VIDEO** HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYLABS/AKAMAI/TEMPLATE/VIDEO640X480.PHP?TITLE=FUSES%20AND%20CIRCUIT%20BREAKERS&CLIP=PANDC/CHET/2012/AUTOMOTIVE/AUTO_SHOP_SAFETY/CLIP18FUSES1.MOV&CAPTION=CHET/CHET_MYLABS/AKAMAI/2012/AUTOMOTIVE/AUTO_SHOP_SAFETY/XML/CLIP18FUSES1.XML
 	**DISCUSSION: HAVE THE STUDENTS TALK ABOUT THE DIFFERENT COLORS FOR AMPERAGE RATINGS. WHY ARE COLORS A GOOD IDEA?**

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	**DEMONSTRATION: DEMONSTRATE SEVERAL DIFFERENT TYPES OF CONNECTORS, INCLUDING THOSE WITH CONNECTOR POSITION ASSURANCE CLIPS. EXPLAIN THAT IT'S NECESSARY TO GUARANTEE THAT CONNECTORS WILL STAY TOGETHER IN SUPPLEMENTAL RESTRAINT SYSTEMS. DEMONSTRATE REMOVAL OF TERMINALS FROM SEVERAL DIFFERENT TYPES OF CONNECTORS.**
	**MAKE SURE TO HAVE PROPER TERMINAL REMOVAL TOOLS AVAILABLE FOR TEACHING STUDENTS ABOUT DIFFERENT CONNECTORS.**
	**DISCUSSION: DISCUSS PROCESS OF SOLDERING WIRES AND THE TYPE OF SOLDER USED. WHAT DO THE PERCENTAGES OF EACH ALLOY IN A SOLDER DETERMINE?**
	**DEMONSTRATION: DEMONSTRATE USE OF A SOLDERING IRON TO CONNECT WIRING. POINT OUT TO THE STUDENTS THAT THEY SHOULD MAKE SURE THAT THE SOLDER JOINT IS SMOOTH; OTHERWISE, A SHARP POINT COULD PUNCTURE SHRINK WRAP AND CAUSE A SHORT CIRCUIT**
	**COMPLETE NATEF TASK SHEET REMOVE AND REPLACE TERMINAL END FROM CONNECTOR; REPLACE CONNECTORS AND TERMINAL ENDS**
	**COMPLETE NATEF TASK SHEET REPAIR WIRING HARNESS (INCLUDING CAN/BUS SYSTEMS)**
	**COMPLETE NATEF TASK SHEET PERFORM SOLDER REPAIR OF ELECTRICAL WIRING**
	19. **SLIDES 19-20 EXPLAIN** Speed Sensors and TP Sensors
	**DISCUSSION: PROVIDE THE STUDENTS WITH A WIRING DIAGRAM OF A TP CIRCUIT TO STUDY AND DISCUSS. WHAT IS THE FUNCTION OF EACH WIRE CONNECTED TO SENSOR?**

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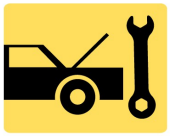
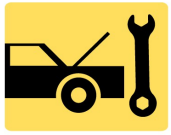
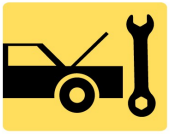
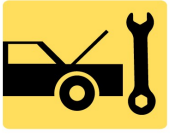
	**HANDS-ON TASK:** HAVE STUDENTS LOCATE AND VISUALLY INSPECT A TP SENSOR FOR PROPER CONNECTION, ATTACHMENT, AND CONDITION.
	SOME TP SENSORS HAVE 4 WIRES. THE FOURTH WIRE IS COMMONLY A SWITCH CIRCUIT USED TO PROVIDE A SIGNAL THAT VEHICLE IS AT IDLE.
	SOME TP SENSORS GO BAD IN ONLY ONE SPOT—VEHICLES THAT ARE DRIVEN AT CONSTANT SPEEDS TEND TO WEAR THE TP IN ONE SPOT.
	**ANIMATION: TP OPERATION** **WWW.MYAUTOMOTIVELAB.COM** HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYAUTOMOTIVELAB_2/ANIMATIONS/A16_ANIMATION/CHAPTER55_FIG_55_11/INDEX.HTM
 	**DISCUSSION:** HAVE STUDENTS DISCUSS HOW TP SENSORS AFFECT AUTOMATIC TRANSMISSION FUNCTION. HOW COULD VARIOUS TP MALFUNCTIONS CAUSE ABNORMAL AUTOMATIC TRANSMISSION OPERATION? IF YOU FIND THAT TP SENSOR IS MISSING ITS VREF SIGNAL, CHECK OTHER SENSORS THAT OPERATE ON SAME VREF SIGNAL. IF OTHER SENSORS ARE ALSO MISSING THEIR VREF SIGNAL, THE PROBLEM MAY BE INSIDE THE COMPUTER.
	
 	**DEMONSTRATION:** SHOW HOW TO USE A DMM TO TEST TP SENSOR FOR PROPER OPERATION. BE SURE TO DEMONSTRATE PROPER TECHNIQUES THAT SHOULD BE USED TO PREVENT WIRE, TERMINAL, CONNECTOR DAMAGE
 	**ON-VEHICLE NATEF TASK** INSPECT AND TEST THROTTLE POSITION SENSOR USING A GMM)/(DSO); PERFORM NECESSARY ACTION
 	**ON-VEHICLE NATEF TASK** INSPECT & TEST PCM/ECM, ACTUATORS, & CIRCUITS USING GMM/DSO; PERFORM NECESSARY ACTION
	21. **SLIDE 21 EXPLAIN** Networks and Network Classification 22. **SLIDE 22 EXPLAIN Figure 14–58** A typical BUS system showing module CAN communications and twisted pairs of wire.

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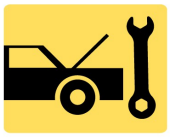
 	**DISCUSSION:** HAVE THE STUDENTS TALK ABOUT THE DIFFERENT TYPES OF COMMUNICATION BETWEEN MODULES OR NODES. WHY DO THERE NEED TO BE DIFFERENT TYPES OF COMMUNICATION?
	**DEMONSTRATION:** DEMONSTRATE OR EXPLAIN TO THE STUDENTS HOW A POWER WINDOW SYSTEM WORKED 10 YEARS AGO AND HOW A MODERN POWER WINDOW SYSTEM WORKS. USE PROJECT BOARD TO DEMO CAN & NETWORK COMMUNICATION
	HANDS-ON TASK: PRINT OUT STEPS FOR DIAGNOSING AND TESTING NETWORK DIAGNOSTIC CODE. ASK STUDENTS TO FOLLOW DIAGNOSTIC STEPS TO SEE REPAIR PATH.
	23. SLIDES 23-25 EXPLAIN Summary